



State of Illinois

# ENVIRONMENTAL PROTECTION AGENCY

Mary A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

217/782-6760

Refer to: L1630200005 -- St. Clair County  
Sauget Sites (Area 1) -- Sauget  
Superfund/General Correspondence

May 6, 1993

Mr. Eric Morton  
PRC Environmental Management, Inc.  
233 North Michigan Ave. - Suite 1621  
Chicago, Illinois 60601

Dear Eric:

As promised, please find enclosed the documents you had wanted to copy on Tuesday.

If you have any questions or concerns, do not hesitate to call.

Sincerely,

A handwritten signature in black ink, appearing to read "Paul E. Takács", written over a horizontal line.

Paul E. Takács, Project Manager  
Federal Sites Management Unit  
Division of Remediation Management  
Bureau of Land

Enclosure - Area 1 Correspondence

cc: Division File (w/o enclosure)



TO: DISTRIBUTION LIST DATE: 1-18-90  
FROM: PAUL TAKACS, FSMU ☒ Information only  
SUBJECT: SAUGET SITES (AREA I) ☐ Response requested

ATTACHED IS THE MOTO ~~Corp~~ INC. RESPONSE TO THE DEC 15 INFO REQUEST LETTER. ALTHOUGH MOTO HAS NO OWNERSHIP IN SITE G, MR. FORSYTH PRODUCED EVIDENCE OF A LEASE MADE W/ RODGERS CARTAGE ON MOTO PROPERTY. DANIEL SAUGET (SAUGET FARMS) FARMED THE PROPERTY SOUTH OF SITES G + H.

cc: BRUCE CARLSON  
JIM MORGAN  
CHRISTINE ZEMAN



January 12, 1990

Paul Takacs  
Division of Land Pollution Control  
P.O. Box 19276  
Springfield, IL 62794-9276

re: Area 1, Sauget, IL

Dear Mr. Takacs:

Thank you for spending the time with me on the phone on January 3, 1990 discussing the above reference project. As you know Moto, Inc. has been named a PRP in this matter.

In our phone conversation, I told you that I believe the questions contained in your department's correspondence to me were largely not applicable in Moto, Inc.'s instance, considering that share cropping was the only activity that has ever occurred on our property.

You stated that the information that you really need is a) any contracts concerning the farming of this property, b) any information we may have about any dumping that has occurred in the vicinity of our property, and c) any information on the fenced in area that is to the North of our property.

Enclosed please find all of the information in my possession that meets the above criteria.


We also discussed the status of your discussions with the various PRPs in Area 1. You stated that it appeared Cerro was going to take a lead role as a PRP. I appreciate your offer to keep me informed as to your discussions with Cerro.

I understand that you are in the process of deciding how you will handle/treat smaller PRPs, such as myself, who only involvement in Area 1 appears to be that they own property that has been affected by others. Of course, I am eager to hear any decision you may make regarding treatment of PRPs in my category.

Unless I hear from you further, I will consider this letter and its attachments my required response to your department's letter naming my company as a PRP.

Please be assured that I am more than willing to assist in your investigations in any way I can.

Sincerely,



Robert J. Forsyth

THIS LEASE, made and entered into this 1st day of July, 1958,  
1958 by and between MOTO-GAS, INC., an Illinois corporation, hereinafter called the  
Lessor, and ROGERS CARTAGE CO., INC., an Illinois corporation, 121 Bremen Avenue,  
St. Louis, Missouri, hereinafter called Lessee.

**WITNESSETH:**

That the Lessor, for and in consideration of the rents, covenants and agreements hereinafter mentioned and hereby agreed to be paid, kept and performed, by said Lessee, has leased, and by these presents, does lease, to said Lessee, the following described premises situated in St. Clair County, Illinois, being more particularly described as follows:

One (1) acre, more or less, of that portion of a certain tract of land, known as Lots #203 and #206, of Subdivision of part of the Commonfields of Cahokia, or Survey #759; reference being had to the plat thereof recorded in the Recorder's Office of St. Clair County, Illinois, in Book of Plots "A" on page 60,

said land being situated on the north side of a certain filling station presently situated upon said tract of land.

65 TO HAVE AND TO HOLD, the same, unto the Lessee, from the 1st day of July, 31st <sup>March, 1968</sup> 1968 until the 30th day of June, 1968. And the Lessee in consideration of said demise, does covenant and agree with the Lessor as follows:

300.  
~~(\$450.00)~~ Dollars, payable on the first day of each and every month of said term, at the office of the Lessor.
- ✓ 2. To use the premises for no other purpose of business than that of repairing, servicing, and <sup>garaging</sup> ~~storing~~ the trucks and motor equipment ~~belonging to the lessee.~~
3. To comply with all county, state and Federal ordinances, laws and statutes enacted with reference to the use and occupancy of said premises and agrees to keep said premises in a neat, clean and presentable condition.
- ✓ but 4. To purchase the gasoline pump now located on said premises at the accepted code price within ten (10) days of the effective date of this lease.

# Dead Creek — no quick cure in sight

By Mike Myers  
Staff Writer

CAHOKIA — Unless something drastic happens, Dead Creek will still be dead at the end of next year, according to the Illinois Environmental Protection Agency.

The IEPA rates the Sauget District Sites — 12 land sites and six segments of Dead Creek — as one of the largest and most highly contaminated areas in Illinois. Those 18 sites, left by a number of chemical companies, cover approximately 220 acres around Cahokia and Sauget and contain an estimated 7.5 million cubic yards of contaminated material that contains heavy metals, chlorobenzene, pesticides, PCBs and dioxins.

But, because it lacks the funds to do anything, the IEPA said there is little hope any cleanup will take place next year.

Dead Creek is one of 20 case studies the IEPA cites in its report, "Cleaning Illinois: The Challenge Facing Illinois Haz-

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ardous Waste Cleanup Efforts." The report lists more than 100 sites across the state that will not be cleaned up if the IEPA budget remains intact.

According to the report the IEPA has spent more than \$1.3 million since 1985 trying to determine the magnitude and extent of the contamination. All the source areas have been identified, the report says, but the complete extent of contamination has not been determined.

In July, Cerro Copper Products Co. agreed to clean up one segment of Dead Creek, removing 25,000 cubic yards of PCB-contaminated sediments. But,

the report says, little else can be expected in the near future.

"The report is pretty bleak, but it's realistic," said Terry Ayers of the IEPA. "There is just not a lot of hope for adequate state funds."

Even more frightening to Ayers is the fact that the money shortage has halted the work on the projects, forcing the managers to move to other areas.

"These people may not come back," he said. "And even if they do, it's not something you can just pick up where you left off."

Because Dead Creek is located right across the river from Mis-

souri, a state competing with the area for industry and business, the existence of a contaminated site has an adverse economic impact.

The IEPA report quotes Cahokia Village Planner Paul McNamara: "Some cleanup may be getting done voluntarily, but that's not the case with many. If somebody's not standing over them with a two-by-four waiting to smack them, I don't believe that they'll ever address the issue."

McNamara said the border areas of Illinois are the battleground of economic development with other states and need to have a "clean and pristine" image.

"These (other) states can always draw on Dead Creek as a prime example of why industry shouldn't locate in Illinois. The French called it Rogoiet Creek, but now it's called Dead Creek and it's synonymous with pollution. Nobody in their right mind would buy a house in that area."

# NEWS

## Monsanto

FOR RELEASE IMMEDIATE

Andi Smith, Monsanto  
618/482-6322 (W)  
314/832-1621 (H)

*41636200005 - St Clair  
Sauget Sites (CS-B) - Sauget  
Superfund / General Corros*

**MONSANTO TO COLLECT SAMPLES  
FROM DEAD CREEK**

Sauget, Illinois, October 11, 1991 -- Beginning Monday, October 14, Monsanto Company will be collecting soil samples from a portion of Dead Creek and adjacent sites to determine the types of chemicals present. The chemicals have come from a number of industrial and commercial sources over the past 75 years.

The Illinois Environmental Protection Agency is being kept informed of the sampling, as part of a long-range, environmental program by Monsanto to evaluate whether corrective action is warranted or feasible.

The part of the creek being tested runs from Queeny Avenue to Judith Lane in Sauget and Cahokia and is fully enclosed by a chain-link fence. Adjacent sites are also a part of the sampling due to their proximity to the creek.

None of the property is owned by Monsanto, however the owners of the properties are cooperating with Monsanto and its sampling program.

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Cahokia-Dupe  
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## Monsanto to take samples at Dead Creek

By Jeffrey Peyton  
Staff writer 10

Monsanto Chemicals has decided to take the lead in the corporate effort to clean Dead Creek and adjacent sites.

Monday, Monsanto will begin collecting soil samples from Dead Creek as a first step in determining what cleanup efforts will be necessary.

Dead Creek, which runs through Cahokia and Sauget, first gained prominence as a hazardous waste site in 1969 when a dog died of chemical burns after rolling in the creek.

Preliminary investigations then revealed quantities of white phosphorous on the surface of the creek, along with high concentrations of deadly PCBs and more than 30 other hazardous chemicals up to 30 feet underground.

Andi Smith, spokesman for Monsanto's Krummrich plant in Sauget, said Monsanto will spend the next several months collecting soil samples and testing the samples for hazardous chemicals.

"We'll use this information to evaluate corrective action," Smith said.

The portion of Dead Creek being tested runs from Quency Avenue in Sauget to Judith Lane in Cahokia. None of the property being tested is owned by Monsanto.

Smith said Monsanto is taking the lead in the cleanup study out of the company's commitment to cleaning the environment. ✓

**Table 1. Apparent Partition Coefficient of DCB with HA as the Equilibrium Solution Concentration of DCT Increases**

DCB partition coeff ( $K_p$ ), mL/g	DCT equilibm solution concn, $\mu\text{g/L}$	DCB apparent partition coeff ( $K^*_B$ ), mL/g
14.9	120	13.5
14.9	180	12.9
14.9	1200	7.4

lowering of 1 °C temperature there was approximately 0.015  $\mu\text{g/L}$  more interaction between DCT and HA. These studies suggest that the temperature phenomenon can have a significant effect in terms of organic compound movement and stability during winter months, as more of it can be bound to humic substances during colder temperatures.

Upon interacting a mixture of DCT (120  $\mu\text{g/L}$ ) and DCB (110  $\mu\text{g/L}$ ), we found that no marked difference from the original uptake (if separately interacted) could be observed. It was also determined that under these low concentrations, no significant difference was found between the calculated partition coefficient  $K_p$  (14.9 mL/g) and the apparent partition coefficient  $K^*_B$  (13.5 mL/g) of DCB (Table 1). However, as is implied from eq 2 [Curl and Keolelan (2)], as the equilibrium concentration of the DCT increases, the  $K^*_B$  decreases appreciably. From the table it is shown that with increases in the equilibrium concentration of DCT in solution, the apparent partition coefficient of DCB decreases from 13.5 to 7.4 mL/g.

### Conclusions

(1) A method for the study of the interaction of VOCs with dissolved humic acid was developed using a combination of reversed-phase and purge and trap gas chromatography.

(2) Partition coefficients for these compounds were calculated and they increased with increasing molecular weight.

(3) The humic acid-DCT interaction was found to be biphasic in nature.

(4) Lowering the temperature of solutions resulted in the increased binding of DCT to humic acid.

### Acknowledgments

We thank Norman Farris for laboratory assistance, and James Latimar and Evelyn Dyer for assistance in the preparation of the manuscript.

**Registry No.** Water, 7732-18-5; dichlorotoluene, 29797-40-8; dichlorobenzene, 25321-22-6; trichloroethene, 79-01-6.

### Literature Cited

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## Toxic Volatile Organic Compounds in Urban Air in Illinois

Clyde W. Sweet\* and Stephen J. Vermette

Illinois State Water Survey, 2204 Griffith Drive, Champaign, Illinois 61820

■ Airborne concentrations and sources of 13 toxic volatile organic compounds (VOCs) were evaluated in two urban areas in Illinois: southeast Chicago and East St. Louis. Concentrations and meteorological conditions were monitored between May 1986 and April 1990. Using emissions inventories and source signatures developed for the study areas, we applied wind trajectory analysis, factor analysis, and a chemical mass balance model to interpret the data. These analyses indicate that most of the toxic VOCs in the study areas come from urban area sources such as vehicle exhaust, evaporation of petroleum products, and solvent emissions by commercial and industrial sources. Emissions from large industrial point sources increase VOC concentrations within 1 km from the source, but have little effect on the overall air quality in the study areas.

### Introduction

During the past few years, an increased awareness of air pollutants and new potential sources of airborne toxic

chemicals have brought a concern that the release of these materials may be a health hazard. Airborne lead has been implicated as a cause of neurological problems in urban children (1). This finding resulted in the promulgation of an ambient air quality standard for lead, its removal from gasoline, and subsequent dramatic lead reductions in urban air. Recently a number of other airborne metals and volatile organic compounds (VOCs) have been identified as important cancer risk factors in the urban environment (2). These compounds are not routinely monitored in urban air, and no national ambient air quality standards have yet been established for them.

Data on airborne VOCs in urban and rural areas in the United States have been reviewed (3, 4). Elevated levels of benzene and other aromatic hydrocarbons as well as a variety of chlorinated VOCs are found in the air of most urban areas. These air pollutants are emitted by a wide variety of area and point sources. Area sources are those involving many small sources over a wide area, such as vehicle emissions. Point sources are single large emitters

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restricted to a small area; industrial sources are usually in this category. The relative importance of individual sources can be estimated using emissions inventories (5), chemical mass balance (CMB) statistical methods (6), or wind trajectory analysis (7). Each of these approaches has its individual strengths and drawbacks. Source by source verification of emissions inventories is expensive, and if not verified, such inventories tend to underestimate pollutant levels. CMB methods provide an independent estimate of source strengths from monitoring data, but there are large uncertainties in the results due to uncertainties in the chemical profiles used to differentiate sources. Finally, wind trajectory analysis is most useful when sources are relatively isolated geographically.

This project focuses on two urban areas in Illinois where high levels of toxic VOCs are anticipated: East St. Louis and southeast Chicago. Each of these communities has both the normal area sources associated with metropolitan zones and specific industrial point sources that add to the load of toxic VOCs in the air. Concentrations of airborne trace metals and some criteria air pollutants such as PM-10 and SO<sub>2</sub> are relatively high in these areas (8), and many of the sources responsible for these pollutants also emit VOCs. The purpose of this project was to monitor airborne concentrations of a selected group of toxic VOCs in the two urban study areas. By applying wind trajectory analysis and a chemical mass balance model, and evaluating existing emission inventories, we can estimate the relative importance of the major sources of these VOCs to the atmosphere. This multiple approach with several lines of corroborating evidence is used to produce a more reliable overall evaluation of the sources of toxic VOCs in the study areas.

#### *Urban Study Areas*

The Chicago study area is a 64-km<sup>2</sup> area in southeast Chicago bounded by 95th St. to the north, the Indiana state line to the east, the Chicago city limits to the south, and State St. to the west. Iron and steel and related industries dominate the study area's manufacturing base and inventoried emissions. These industries are largely confined to a north-south strip running on both sides of the Calumet River. Associated with the iron/steel industries are large tracts of land that serve as open storage locations for coal, slag, scrap steel, limestone, and other raw materials. Other significant facilities include an auto assembly plant, a municipal sewage treatment works, a hazardous waste incinerator, and numerous landfills. There are oil refineries to the west of the study area and also to the east of the study area in Indiana. Air quality was measured at three sites from May 1986 to April 1990. The locations of these sites and the major point sources are shown on the map in Figure 1.

The East St. Louis study area is bounded by the Mississippi River on the west and includes the municipalities of East St. Louis, Sauget, and Cahokia. The city of St. Louis is located to the west of the study area, across the Mississippi River. The dominant manufacturing activities in the study area are copper and zinc smelting and organic chemical production. Air quality was measured at two sites in this area from November 1986 to April 1990. A map showing these sites is given in Figure 2.

Additional samples were collected at a rural site near Champaign, IL, 8 km south of Bondville, IL. This site was chosen to be representative of nonurban regional air quality and is also used in several national air and precipitation monitoring programs. There are no point sources within 10 km and the site is at least 50 km downwind of urban areas during times of prevailing

northwest and southwest winds. In this location, concentrations of airborne toxic air pollutants are representative of conditions in most of rural Illinois and provide an estimate of the contribution of regional background to urban pollution. Samples were collected here between February 1987 and April 1990.

#### *Experimental Methods*

**Sampling Methods.** Samples were collected in Summa-polished, stainless steel, 6-L canisters (SIS, Inc., Moscow, ID). These canisters are capable of holding air samples for up to 30 days with no significant change in the concentrations of target VOCs (9). The canisters were cleaned by flushing three to five times with humidified "zero air" (Linde Specialty Gases, Zero Grade) and evacuated with a high-vacuum pump. After evacuation, the canisters were pressurized with zero air, allowed to equilibrate, and analyzed for the target compounds. Successful cleaning resulted in concentrations of target compounds that were less than 10% of the concentrations found in background air.

Ambient samples were taken using computer-controlled, commercial automatic samplers (SIS, Inc.) capable of taking up to six independent air samples in separate canisters. The samplers feature a stainless steel pump with a Viton diaphragm (Model N 05 SV, Newberger Corp, Princeton, NH), a flow controller (Millaflow, Model S-C423BFT, Veriflow Corp., Richmond, CA) and latching stainless steel solenoid valves (Datron-EEMCO, Inc., Los Angeles, CA). All transfer lines are stainless steel. Upon receipt, the samplers were purged for several hours with clean moist air while heat was applied to all valves and lines with a heat gun. Sampler flow rates were set at 6-12 mL/min using a bubble flow meter at the beginning of each run. Flow rates varied by less than 10% when rechecked at the end of the sampling period. Between 7 and 10 L of ambient air were collected for a typical sample.

The use of a sampler to collect air for trace VOC analysis raises the possibility of either contaminating the sample or removing compounds from the sample due to wall losses on sampling lines and valves. As a quality assurance check, the recovery of the target compounds and contamination of the SIS samplers were evaluated by simultaneous sampling with a canister equipped with a 30-gauge needle as a critical orifice (10). The needle/canister combination allows precise sampling with a minimal sampling line. Comparison of collocated samples taken using the needle/canister and the SIS sampler makes it possible to evaluate sampler effects that may be encountered with the more complex SIS sampler in the field. The sampler flow rates in this experiment were set at 30 mL/min to correspond to the constant flow through the needle. The collection period was 2 h. Additional compounds occurring in the SIS samples are due to contamination from the sampler. Low recoveries are due to wall losses in the sampling train. Both of these possibilities can be evaluated at the same sub-ppb concentrations found in actual ambient samples. In general, differences in concentrations of target compounds were within analytical error ( $\pm 20\%$ ). This indicates that no significant contamination was present and recoveries of target compounds were acceptable. One sampler did exhibit styrene/o-xylene contamination after one field sampling period. The styrene/o-xylene concentrations were discarded in this case and the sampler was recleaned. One of the samplers also exhibited contamination due to an unidentified halocarbon which interfered with the determination of methylene chloride. Concentrations of this target compound could not be determined using this sampler. Recoveries were also poor

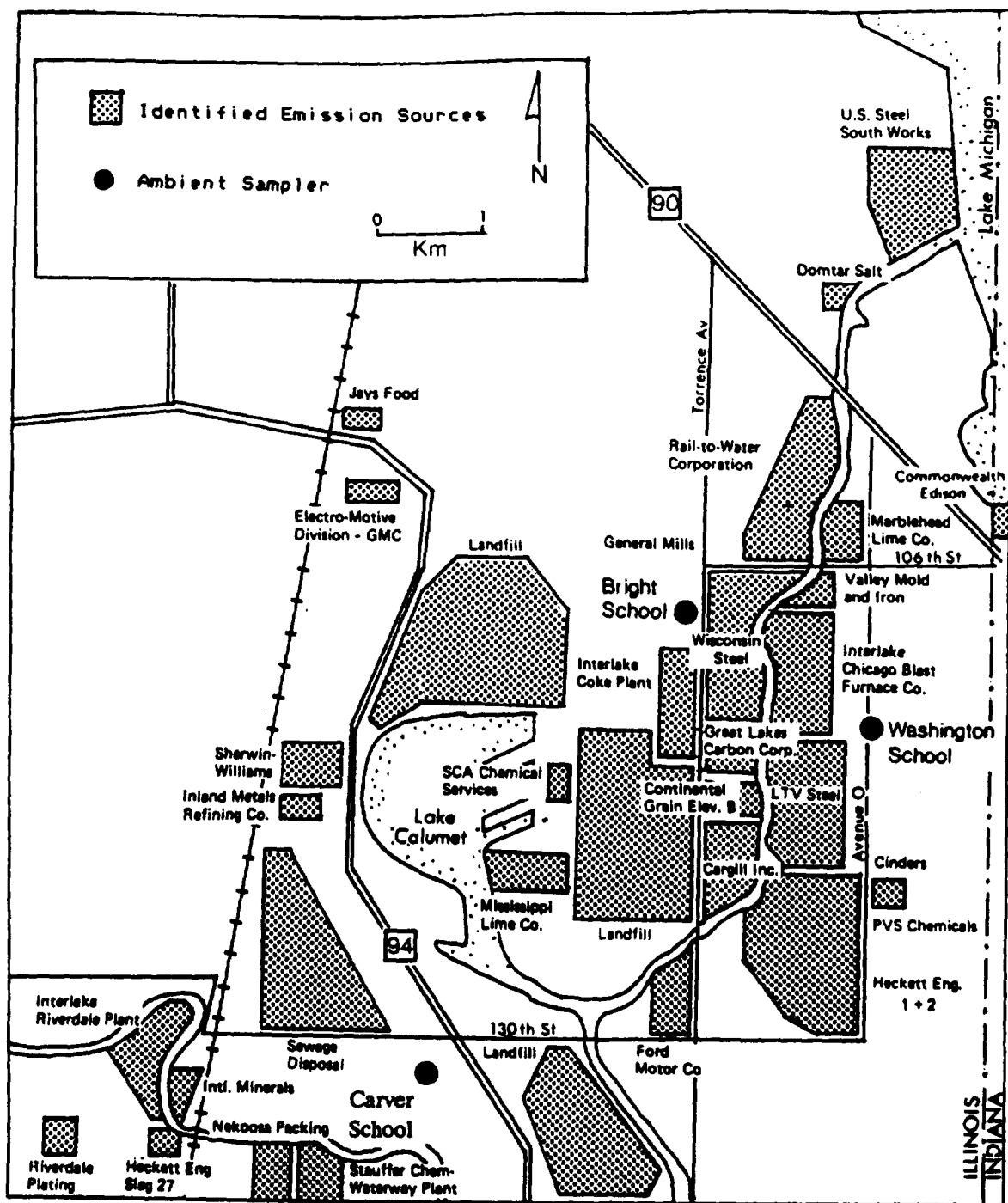


Figure 1. Southeast Chicago study area.

(25% or less) for a number of unidentified compounds that elute from the gas chromatograph after the target compounds. This is presumably due to wall losses and indicates that the SIS sampler may not be appropriate for compounds less volatile than the xylenes.

**Analytical Methods.** The following analytical procedures were adapted from methods developed by U.S. EPA researchers (11). When the canisters were received at the laboratory, the pressure in the canisters was measured and adjusted to 2.0 atm with dry zero air. After adjusting for sample dilution, the equivalent of 0.5 L of sampled air was passed over a liquid nitrogen cooled trap into a calibrated receiving flask fitted with a precision vacuum gauge. Trapped oxygen was released by removing the liquid nitrogen Dewar until the vacuum gauge reading stabilized (a few seconds). The trapped sample was then released by heating the trap to 80 °C in a water bath and back-

flushed onto the chromatographic column through a six-port gas sampling valve.

A Hewlett-Packard 5890A gas chromatograph (GC) equipped with flame ionization (FID) and electron capture (ECD) detectors was used. The chromatographic column was a 30-m, 0.325-mm-i.d. fused-silica capillary column with a 1.0- $\mu$ m-thick film of DB-5 bonded liquid phase (J&W Scientific, Rancho Cordova, CA). The column effluent was split 10:1 between the FID and ECD using a fused-silica capillary outlet splitter (SGE, Inc., Austin, TX). The temperature program was from -35 to 200 °C at 8 °C/min. Compound identification was by retention time and quantification by peak height. Injector temperature was 200 °C, detector temperatures were 275 °C, and helium was the carrier gas.

The GC was calibrated using an eight-compound standard containing 100 ppbv benzene, toluene, and *m*-

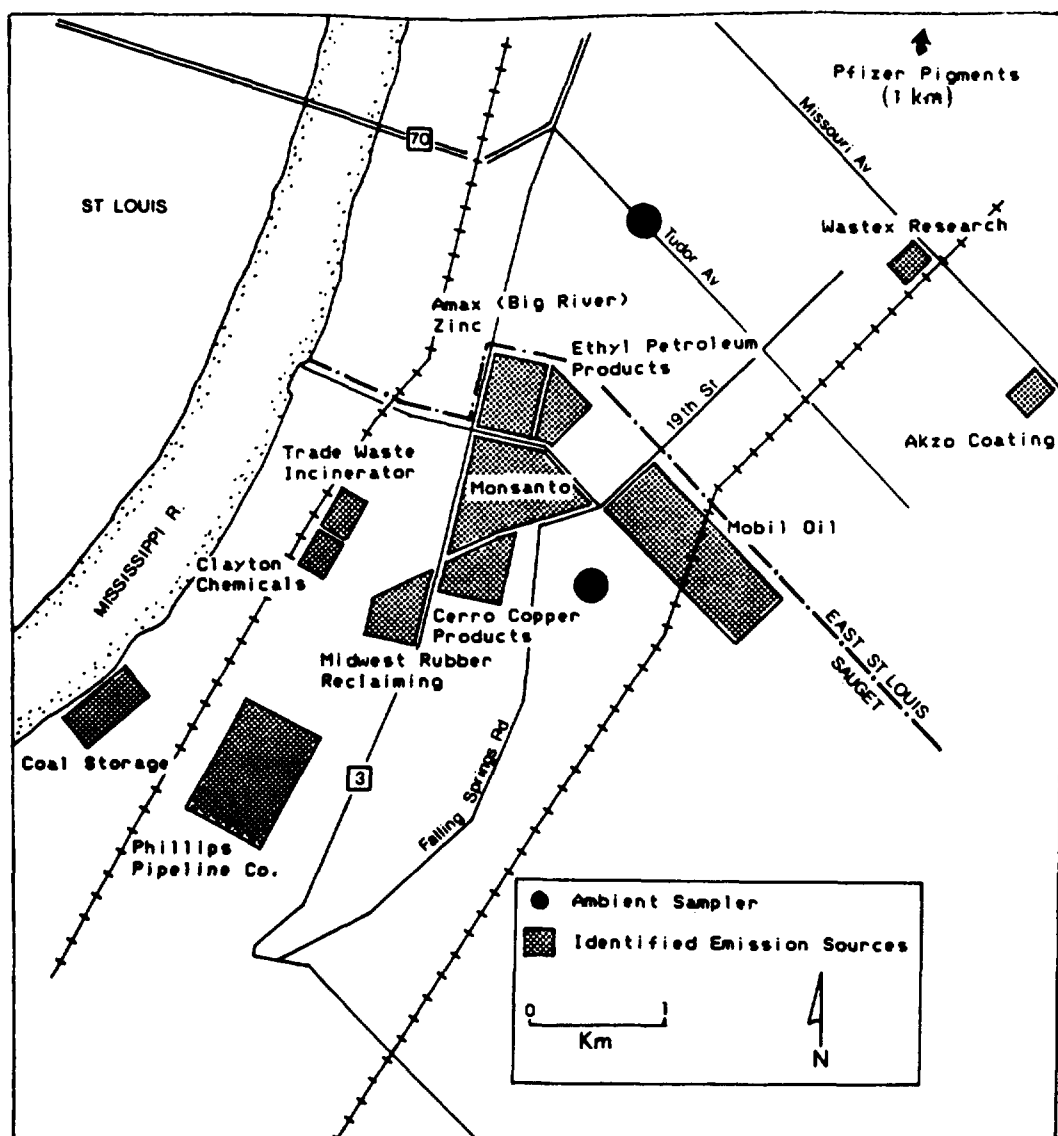


Figure 2. East St. Louis study area.

xylene and 10 ppbv chloroform, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, and tetrachloroethylene (Scott Specialty Gases, Plumsteadville, PA). This standard mixture was diluted with clean humidified air to give a working standard with final concentrations of 50 ppbv for the aromatics and 5 ppbv for the chlorinated hydrocarbons. The diluted standard was analyzed daily in the same way as a typical air sample. Recovery of compounds in the standard from the canisters was 80–120%. Dilution experiments showed that the responses of the detectors are linear throughout the analytical ranges of all the compounds except carbon tetrachloride and tetrachloroethylene. The response of the ECD to these two compounds decreased markedly at concentrations below 1 ppbv, and their concentrations were determined using a calibration curve.

Several compounds were analyzed that were not in the calibration standard. Standards for methylene chloride, ethylene dibromide, styrene, chlorobenzene, and *m,p*-dichlorobenzene were prepared using the static dilution bottle technique (12). The working standard had concentrations of 1 ppbv.

#### Results and Discussion

**Data Summary.** Between 1986 and 1990, over 200 air samples were collected in the urban study areas and at our

rural background site. Thirteen of the target VOCs could be quantified in over 95% of the samples. The concentrations found for these compounds are shown in Table I. In the case of the meta and para isomers of xylene, only the sum is given because these two compounds are not separated by the gas chromatograph. Likewise, styrene and *o*-xylene could not be reliably separated and so are reported together.

Average airborne VOC concentrations in the study areas are similar to those measured in Chicago outside industrial zones (6) and to those in other urban areas without major industrial sources (4, 13). This indicates that emissions from industrial sources are relatively unimportant for these compounds. O'Shea and Scheff (6) reported that in central Chicago area emissions from vehicles and evaporation of gasoline account for 72% of total VOCs and 96% of the benzene in ambient air. Since average benzene levels are no higher in southeast Chicago, it seems likely that these sources are also predominant here.

For most of the compounds in Table I, average urban concentrations are 2–10 times higher than the regional background levels measured at our rural site in central Illinois. The urban concentrations are much more variable than those found at the rural site, as indicated by the higher standard deviations and maximum values found for most compounds in the urban areas. The average con-

**Table I. Mean Concentrations ( $\mu\text{g}/\text{m}^3 \pm \text{SD}$ ) of Airborne Toxic VOCs<sup>a</sup>**

compound	Chicago <sup>b</sup> (n = 103)	E. St. Louis <sup>b</sup> (n = 83)	rural site (n = 23)
benzene	4.6 $\pm$ 6.6 (54)	10.6 $\pm$ 17.2 (102)	1.3 $\pm$ 0.5 (2.4)
toluene	8.9 $\pm$ 8.9 (56)	8.5 $\pm$ 9.3 (45)	3.0 $\pm$ 2.3 (9.5)
<i>m</i> -, <i>p</i> -xylene	3.9 $\pm$ 8.3 (22)	16 $\pm$ 42 (312)	1.2 $\pm$ 0.8 (3.9)
ethylbenzene	1.4 $\pm$ 1.2 (7.6)	6.9 $\pm$ 17 (110)	0.4 $\pm$ 0.3 (1.6)
<i>o</i> -xylene/styrene	2.9 $\pm$ 5.5 (44)	3.3 $\pm$ 8.6 (55)	1.1 $\pm$ 0.9 (4.3)
chloroform	0.3 $\pm$ 0.2 (1.6)	0.5 $\pm$ 0.9 (6.6)	0.3 $\pm$ 0.1 (0.4)
1,1,1-trichloroethane	3.3 $\pm$ 3.5 (25)	3.9 $\pm$ 6.1 (31)	1.1 $\pm$ 0.6 (1.9)
carbon tetrachloride	0.7 $\pm$ 0.2 (1.7)	0.9 $\pm$ 0.3 (1.7)	0.8 $\pm$ 0.2 (1.2)
trichloroethylene	1.0 $\pm$ 1.0 (5.9)	2.1 $\pm$ 5.8 (43)	0.6 $\pm$ 0.5 (1.5)
tetrachloroethylene	1.8 $\pm$ 1.6 (9.1)	1.4 $\pm$ 1.3 (6.1)	0.4 $\pm$ 0.3 (1.2)
chlorobenzene	0.3 $\pm$ 0.2 (1.6)	3.0 $\pm$ 6.3 (36)	0.2 $\pm$ 0.1 (0.5)

<sup>a</sup>Maximum value in parentheses; *n* is the number of samples.  
<sup>b</sup>Samples collected at multiple sites in the study areas.

centrations of a few compounds are not significantly different from those measured at the background site. The best example is carbon tetrachloride. This compound was removed from commercial use many years ago, so current releases are very small. However, carbon tetrachloride has a very long atmospheric residence time and has become well mixed in the global atmospheric environment at  $\sim 0.75 \mu\text{g}/\text{m}^3$  (14).

The pattern of urban/rural differences for toxic VOCs is similar to that found for toxic trace elements in the same study areas (15). In both cases, pollutant concentrations tend to approach rural background levels when the wind is from a direction away from nearby industrial sources and the ventilation rate (the product of wind speed and mixing height) is high. Maximum concentrations are associated with periods of low ventilation rates when nearby industrial sources are directly upwind.

**Emission Inventories.** The most complete and up-to-date emission inventory for the urban study areas has been compiled by the Illinois Department of Energy and Natural Resources (16). Four source types are defined within the inventory: process, combustion, incineration, and fugitive emissions. Both point source and area emissions are included and VOC emissions are compiled by individual chemical species. All reported emissions are included along with potential emissions from nonreporting sources. In fact, potential emissions make up over 85% of the total.

We applied a simple box model to these emission factors to estimate the average contribution of various sources to the overall ambient VOC concentrations. In this model, the airspace from the surface to 800 m above the study area (the average of winter and summer mixing heights) is assumed to be ventilated at the average wind speed (12 km/h) or the equivalent of 38 air changes per day. The local emissions diluted by this volume of air give an estimate of the contribution of local sources to average ambient levels of VOCs. In Table II, the results of these calculations are shown for 14 VOCs for which ambient values and inventoried emissions were available. Except for benzene, chlorobenzene, and toluene, inventoried

**Table II. Contribution of Sources to Average Ambient VOC Concentrations**

compound	SE Chicago		E. St. Louis <sup>a</sup>	
	tons/ year <sup>b</sup>	% <sup>c</sup>	tons/ year <sup>b</sup>	% <sup>c</sup>
benzene	3328	92	2753	33
toluene	2693	39	546	8
ethylbenzene	60	5	127	2
<i>o</i> -xylene/styrene	479	21	1650	21
<i>m</i> -, <i>p</i> -xylene	310	10	42	0.3
chlorobenzene	654	278	800	34
chloroform	12	5	9	2
1,1,1-trichloroethane	94	4	18	0.6
trichloroethylene	197	25	18	1
<i>p</i> -dichlorobenzene	81	na <sup>d</sup>	586	na <sup>d</sup>
carbon tetrachloride	20	4	56	8
tetrachloroethylene	173	12	28	3

<sup>a</sup>East St. Louis/Sauget/Cahokia. <sup>b</sup>Source, ILENR (16).  
<sup>c</sup>Percent of average ambient concentration explained by inventoried emissions. <sup>d</sup>na, not available.

**Table III. Wind Trajectory Analysis of Sauget VOC Data<sup>a</sup>**

compound	northwest winds	other winds	overall mean
benzene	30 $\pm$ 8.0	2.2 $\pm$ 2.2*	14 $\pm$ 21
toluene	6 $\pm$ 6	9 $\pm$ 9	8 $\pm$ 9
<i>m</i> -, <i>p</i> -xylene	52 $\pm$ 73	0.5 $\pm$ 0.5*	2.5 $\pm$ 53
trichloroethylene	5.9 $\pm$ 10	0.5 $\pm$ 0.5*	2.7 $\pm$ 7.0
chlorobenzene	5.9 $\pm$ 6.8	0.5 $\pm$ 0.4*	4.0 $\pm$ 7.3
<i>p</i> -dichlorobenzene	58 $\pm$ 61	3.0 $\pm$ 1.8*	38 $\pm$ 54

<sup>a</sup>Concentrations,  $\mu\text{g}/\text{m}^3 \pm$  standard deviation; *n* = 10 for each wind sector; \* indicates values that are significantly lower (*p* > 0.95) than other values in the same row. "Overall mean" is the mean of all samples collected the site.

sources account for 25% or less (often less than 10%) of the average concentrations of these compounds in ambient air. The additional VOCs in ambient air most probably come from a combination of uninventoried or underestimated sources in the study areas (including those emissions from consumer products such as cleaning fluids, hair products, etc.) as well as VOCs already present in the air coming into the study area. In the case of benzene, the inventoried emissions account for most of the measured ambient concentrations. The better accounting for benzene may be due to well-characterized emission sources, such as a chemical complex in Sauget, coke ovens in southeast Chicago, and vehicle emissions in all of the study areas.

**Wind Trajectory Analysis.** The dependence of ambient VOC concentrations on wind direction can be demonstrated using wind trajectory analysis (WTA). With this technique, samples that correspond to periods of steady wind direction (standard deviation of wind direction <20°) are selected for analysis (17). The data in Table III illustrate WTA results. The Sauget site in the East St. Louis study area is  $\sim 0.5$  km southeast of a large chemical complex (see Figure 2). Samples taken during periods of northwesterly winds at this site are compared to samples taken when the wind was coming from other directions. These data clearly indicate that there is a major source of aromatic and chlorinated hydrocarbons northwest of the site. Plotting the concentrations of these compounds against wind direction for individual samples reinforces these conclusions (Figure 3). We confirmed that the chemical plant is the source of these compounds by collecting samples directly upwind during periods of northwesterly wind flow. Upwind samples were indistin-

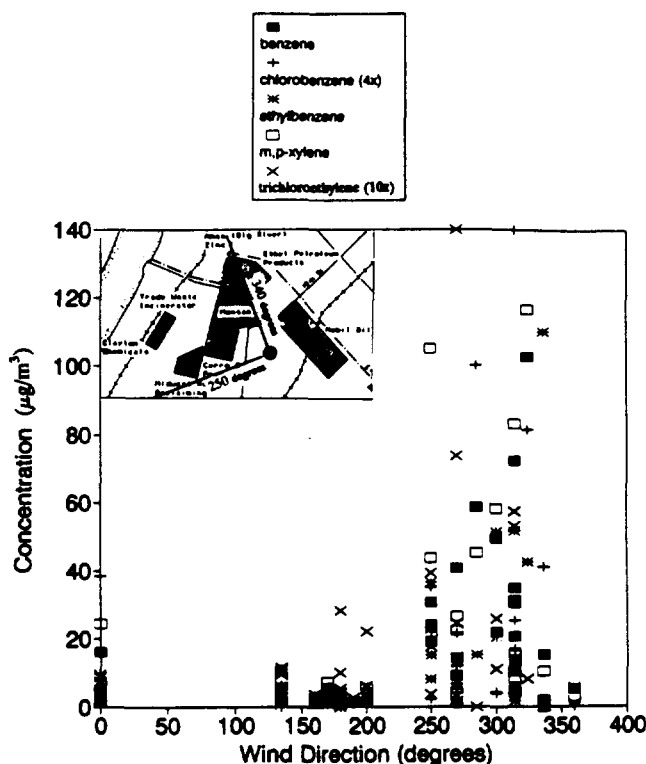


Figure 3. Influence of wind direction on VOC concentrations at Sauget.

guishable from the "other winds" category in Table III.

At our other sampling locations in East St. Louis and Chicago, WTA indicates that local industrial emissions are much less significant. Elevated concentrations of benzene were occasionally observed when a site was directly downwind of an industrial source 1 or 2 km away. However, these episodes did not significantly affect the overall average benzene concentrations at these sites.

**Factor Analysis.** Factor analysis is a multivariate analysis method for characterizing complex data sets and is commonly used in atmospheric chemistry for pollution source identification (18-21). It takes a number of measured variables and finds fewer linear combinations (factors) of those variables that explain most of the variance. These factors represent underlying causal parameters that can be interpreted as identifying possible emission source categories within the study area (17). Factor loadings may be loosely considered as correlation coefficients of the original variable (VOC concentration) with that of a new combination of variables or factors. The closer the factor loading is to 1.0, the more significant is the relationship between the individual variable and factor or between the concentration and a possible source. A factor loading greater than 0.4 is considered significant. Factor analysis requires no a priori knowledge of emission sources and thus is useful as an independent method confirming the importance of known emission sources or suggesting emission sources not inventoried or previously considered. While factor analysis provides a ranking of the importance of a source, identifying and labeling of these sources is based on previous findings, knowledge of the study area, and known emission source characteristics taken from the scientific literature.

A number of "rules of thumb" exist in choosing the number of factors to be interpreted in factor analysis. The most common rule is to keep factors with eigenvalues of  $\geq 1$ . Other methods include keeping only those factors with  $\pm$  errors that do not overlap (Kendal/North criteria) and plotting eigenvalue curves (see refs 17 and 22 for detailed

reviews). To maximize the identification of possible sources, a maximum number of factors that were physically meaningful were retained (17). In practice, this approach matched an eigenvalue  $\geq 1$  criterion.

For Chicago, factor analysis indicated the presence of four sources accounting for 78.4% of the variance. Urban area sources account for 45.3% of the variance and are associated with the following compounds (factor loadings in parentheses): toluene (0.89), ethylbenzene (0.85), *m,p*-xylene (0.84), 1,1,1-trichloroethane (0.87), trichloroethylene (0.80), and tetrachloroethylene (0.70). This factor is attributed to vehicle emissions, gasoline evaporation, and solvent emissions. Individual sources within these categories covaried and could not be separated after numerous iterations with factor analysis. Our inability to separate these sources is, in itself, indicative of the numerous sources and of the thorough mixing of VOCs in the urban airshed. Industrial and commercial sources and consumer products are all likely contributors to this category. A second factor accounting for 8.3% of the variance is only associated with benzene (0.95) and is attributed to coke ovens. This source was previously implicated by WTA and is a major component of the emission inventory. The third factor accounting for 11.4% of the variance is associated with carbon tetrachloride (0.93) and chloroform (0.43). It can be attributed to a regional source from outside the city. An unknown factor characterized by chlorobenzene (0.86) and *o*-xylene (0.90) accounts for 13.4% of the variance.

For East St. Louis, factor analysis indicated the presence of four sources accounting for 86.3% of the variance. The local chemical plant factor includes benzene (0.89), *m,p*-xylene (0.97), ethylbenzene (0.96), trichloroethylene (0.60), 1,1,1-trichloroethane (0.52), and chlorobenzene (0.86), all previously allocated by WTA to the chemical complex in Sauget. This factor accounts for 46.2% of the variance. The second factor, associated with carbon tetrachloride (0.85) and chloroform (0.72), suggests a regional source because these two compounds are relatively high in regional background samples. This factor is also associated with *o*-xylene (0.83) and trichloroethylene (0.52) and accounts for 18.7% of the variance. The third factor is associated with evaporation of chlorinated solvents including tetrachloroethylene (0.94), trichloroethylene (0.52), and 1,1,1-trichloroethane (0.47). Recognized sources of these solvents include wastewater treatment and vapor degreasing; however, no large sources of these compounds have been identified in the study area. This factor accounts for 11.0% of the variance. Finally, a single compound, toluene (0.97), is associated with the fourth factor. This may indicate vehicle emissions if ethylbenzene and *m,p*-xylene are being masked by the chemical plant factor. Alternatively, this factor may indicate other petroleum uses (e.g., evaporation of toluene from petroleum-transfer stations) that are a major component of inventoried hydrocarbon emissions in the study area. This factor accounts for 10.3% of the variance.

**Chemical Mass Balance.** The final method used to characterize sources is the source apportionment of the toxic VOCs. Apportionment statistics were determined from the chemical mass balance model (23). The CMB model, using least-squares fit, estimates the contributions of emission source categories to the ambient air sample. In the standard application of CMB, mass balance equations are written for each compound and source contribution estimates are calculated for the period represented by a particular sample. This approach has the advantage that the number of sources that need to be considered is minimized. If the wind direction is constant during the

Table IV. Source Matrix for CMB Calculations<sup>a</sup>

	coke oven <sup>b</sup>	vehicle exhaust <sup>b</sup>	re-finery <sup>b</sup>	paint <sup>c</sup>	waste-water <sup>c</sup>	graphic arts <sup>c</sup>	auto paint <sup>c</sup>	degreasing solvents <sup>c</sup>	dry cleaning <sup>c</sup>	vehicle exhaust <sup>c</sup>	re-finery <sup>c</sup>	gas vapor <sup>c</sup>	chemical plant <sup>d</sup>
propane	4.8	0.009	17.1	0.0	0.0	0.0	0.0	0.0	0.0	6.7	21.3	1.7	0.0
n-butane	0.02	4.8	14.2	0.0	0.0	0.0	0.0	0.0	0.0	9.0	17.6	41.7	0.0
isopentane	0.05	3.9	13.6	0.0	0.0	0.0	0.0	0.0	0.0	7.2	16.9	20.2	0.0
benzene	21.7	3.6	1.1	0.3	2.3	0.0	0.0	0.0	0.0	6.6	1.4	1.3	68.2
toluene	0.03	7.7	3.8	78.3	6.2	93.1	67.4	0.0	0.0	14.2	4.7	1.3	0.5
ethylbenzene	0.06	1.1	0.5	1.4	1.3	0.0	6.2	0.0	0.0	2.0	0.6	0.4	2.9
m,p-xylene	0.09	3.5	1.2	8.1	0.0	6.9	17.1	0.0	0.0	6.6	1.4	0.4	8.1
o-xylene	0.01	2.1	0.7	8.7	0.0	0.0	5.5	0.0	0.0	3.9	0.8	0.2	0.0
chloroform	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
1,1,1-trichloroethane	0.0	0.0	0.0	0.0	28.4	0.0	0.0	55.1	0.0	0.0	0.0	0.0	8.1
trichloroethylene	0.0	0.0	0.0	0.0	16.4	0.0	0.0	33.4	0.0	0.0	0.0	0.0	1.9
tetrachloroethylene	0.0	0.0	0.0	0.0	19.7	0.0	0.0	11.6	100.0	0.0	0.0	0.0	0.0

<sup>a</sup> Values are weight percent. <sup>b</sup> Chicago profiles (26). <sup>c</sup> Scheff et al. (25). <sup>d</sup> This study.Table V. Average CMB Results (%) for the Southeast Chicago Study Area<sup>a</sup>

VOC	calcd/measd	vehicle exhaust	degreasing solvent	dry cleaners
benzene	1.04	100	0	0
toluene	1.03	100	0	0
ethylbenzene	0.95	100	0	0
m,p-xylene	1.10	100	0	0
o-xylene	0.87	100	0	0
1,1,1-trichloroethane	0.66	0	100	0
trichloroethylene	1.31	0	100	0
tetrachloroethylene	1.00	0	25.3	74.7

<sup>a</sup>  $r^2 = 0.97$ ;  $\chi^2 = 2.72$ ; degrees of freedom  $df = 5$ .

sampling period, only upwind sources affect the sampling site. The major disadvantage is that CMB from a single collection period represents only the time period sampled, not average conditions. CMB analysis of single samples can also be easily distorted by analytical errors.

Our approach to CMB modeling is to use the average results reported earlier (Table I). These results generally reflect average conditions at the site and include proportional contributions from sources located in different locations around the receptor and from samples taken throughout the year. Analytical errors in a few individual samples will not be as significant when averaged into a large database. Although all sources affecting the site need to be considered, we have already narrowed the list considerably by using emission inventories, wind trajectory analysis, and factor analysis. Most of the chemical profiles for various emission sources were obtained from the literature (24). Specific source profiles for the major industrial sources (coke ovens in Chicago and the chemical complex in Saugat) were developed from fence-line air monitoring data upwind and downwind of the source (ref 25 for the coke ovens; Table III for the chemical plant).

A complete list of chemical profiles used is given in Table IV. For comparison, CMB was carried out on individual samples representing both pollution episodes when a particular site was directly downwind of a major source and other wind conditions when no major point sources were upwind of the receptor.

The target compounds listed earlier (Table I) were used as fitting species for CMB. Three additional nontoxic VOCs, propane, n-butane, and isopentane, were also used as fitting species in order to help differentiate vehicle exhaust, gasoline vapor, and refinery emissions. The CMB results list the percent of individual toxic VOC compounds contributed by a particular source. The toxic VOCs considered are those in Table I except for chloroform, carbon tetrachloride, and chlorobenzene. These were not included because their concentrations were generally the same in both urban and background samples. To evaluate the CMB results, two statistics are given that can be used to evaluate the "fit" of the model. The first,  $r^2$ , should be as close to 1 as possible but always greater than 0.8. The second,  $\chi^2$ , should be less than 4 and as close to 1 as possible.

Under average conditions in southeast Chicago, it is apparent that most of the studied toxic VOCs can be attributed to vehicle exhaust (Table V). The fact that vehicle emissions account for 100% of some compounds does not mean that there are no other sources of these VOCs in urban air. It only indicates that the CMB model could find no mix of available source profiles that fits the ambient data better than the attribution given. The fact that the ratios of calculated to measured concentrations of these VOCs are very close to 1 indicates that this source is responsible for most of the ambient air concentration. Sources of other VOCs include solvent evaporation and dry cleaners. The coke ovens appear not to be a significant source of toxic VOCs under average conditions. This is in agreement with wind trajectory analysis findings for

Table VI. CMB Results (%) for a Chicago Sample (Washington School) during a Pollution Episode<sup>a</sup>

VOC	calcd/measd	coke ovens	vehicle exhaust	paint	gasoline vapor	degreasing solvent	dry cleaning
benzene	0.79	71.6	26.3	0.6	2.3	0	0
toluene	0.96	0.8	45.6	52.0	1.8	0	0
ethylbenzene	1.03	17.0	68.3	9.4	5.3	0	0
m,p-xylene	1.06	8.3	71.8	18.4	1.8	0	0
o-xylene	1.01	1.4	68.6	30.3	1.4	0	0
1,1,1-trichloroethane	0.65	0	0	0	0	100	0
trichloroethylene	1.33	0	0	0	0	100	0
tetrachloroethylene	1.00	0	0	0	0	12.9	87.1

<sup>a</sup>  $r^2 = 0.97$ ;  $\chi^2 = 4.31$ ; degrees of freedom  $df = 5$ .

Table VII. CMB Results (%) for Average Data at East St. Louis (Tudor St. Site)<sup>a</sup>

VOC	calcd/ measd	chemical plant	vehicle exhaust	dry cleaning	degreasing solvent
benzene	1.13	48.6	51.4	0	0
toluene	1.59	0.3	99.7	0	0
ethylbenzene	0.30	11.7	89.3	0	0
m,p-xylene	0.42	10.0	90.0	0	0
o-xylene	1.10	0	100	0	0
1,1,1-trichloro- ethane	0.99	18.3	0	0	81.7
trichloro- ethylene	1.01	7.5	0	0	92.5
tetrachloro- ethylene	1.00	0	0	51.3	48.7

<sup>a</sup>  $r^2 = 0.83$ ;  $\chi^2 = 21.6$ ; degrees of freedom  $df = 4$ .

benzene, an important toxic air pollutant from coking operations. When nearby sites like Washington School are downwind of the coke ovens (Table VI), this source can account for more than 70% of the benzene found in ambient air. However, these pollution episodes are relatively infrequent and only make a small contribution to the average benzene concentration at this site. Even during pollution episodes, other sources contribute most of the VOCs to these samples. These sources include vehicle exhaust, paint, gasoline vapor, solvent evaporation, and dry cleaning. Neither CMB nor factor analysis indicates a significant influence from refinery emissions. Although there are no refineries in the Chicago study area, there are several located a few miles to the west and east. Other CMB studies in Chicago have indicated that refinery emissions constitute a significant source of VOCs in Chicago (6). The fact that we were not able to attribute any VOCs to refineries may be due to the fact that we are using a more limited group of fitting species and are unable to differentiate refinery emissions from similar profiles such as gasoline vapors and vehicle exhaust. On the other hand, we have found that major industrial sources in this study do not seem to have a large impact on average VOC concentrations at receptors more than a kilometer or so away. The highly localized influence of industrial point sources is also predicted from meteorological dispersion modeling of inventoried emissions in the southeast Chicago area (26).

Under average conditions in East St. Louis, as in Chicago, vehicle exhaust accounts for most of the toxic VOCs studied (Table VII). The chemical complex in Sauget accounts for the second largest share of toxic VOCs. This is consistent with WTA findings. Other sources include solvent evaporation and dry cleaning (tetrachloroethylene). Individual samples taken at the Tudor Ave. site were also analyzed by CMB. During periods when winds came from the Sauget chemical complex (Table VIII), this source accounts for most of the toxic VOCs found in individual samples. However, these episodes have a relatively small impact on average VOC concentrations at this site. Other sources contributing to such pollution episode samples include solvent evaporation, vehicle exhaust, and gas vapors. CMB analyses also indicate that a separate toluene source is associated with southwesterly air flow at this site. This is consistent with factor analysis results showing toluene as a separate factor or source. The identity of this source is not clear, but it is probably related to the petroleum product transfer and storage stations in the area.

The results from individual samples taken when the receptor was not downwind from the chemical complex are very similar to the average results. The CMB statistics for both the average data and individual "low-pollution"

Table VIII. CMB Results (%) for an East St. Louis Sample during a Pollution Episode<sup>a</sup>

VOC	calcd/ measd	chem- ical plant	vehicle ex- haust	toluene source	dry clean- ing	gas vapor/ re- finery
benzene	0.98	93	4	0	0	4
toluene	1.14	<1	6	89	0	5
ethyl- benzene	0.47	60	20	0	0	20
m,p-xylene	0.67	39	15	38	0	9
o-xylene	1.05	0	63	0	0	36
1,1,1-tri- chloroethane	0.95	100	0	0	0	0
trichloro- ethylene	1.46	100	0	0	0	0
tetra- chloro- ethylene	1.00	56	0	0	44	0

<sup>a</sup>  $r^2 = 0.96$ ;  $\chi^2 = 4.75$ ; degrees of freedom  $df = 5$ .

samples from East St. Louis do not meet the guidelines listed earlier. Several of the aromatic hydrocarbons are poorly predicted. This is probably due to the fact that we do not have specific source profiles for the petroleum-transfer stations that make up a major component of inventoried VOC emissions in this area. Our profiles for the chemical complex are based on a small number of samples so that they too may not reflect the actual emissions very accurately. In spite of these deficiencies, it seems clear that a large proportion of the toxic VOCs we measured in East St. Louis are attributable to area sources rather than industrial point sources.

### Conclusions

In general, the average concentrations of toxic VOCs in the urban study areas are similar to those measured in other urban areas in the United States without major industrial sources. This finding is somewhat unexpected because these study areas are affected by industrial emissions as well as general urban emissions. The air quality in these areas is among the worst in Illinois as measured by criteria pollutants. The relatively good air quality in terms of toxic VOCs indicates that industrial emissions have less of an impact for these pollutants than for criteria pollutants such as  $SO_2$ . This conclusion is supported by the chemical mass balance analysis. For most of the sites, average concentrations of toxic VOCs are largely attributable to area sources such as vehicle exhaust, evaporation of petroleum products, solvent evaporation, and other sources common to all urban areas. Under some circumstances, specific industrial sources can have a significant impact on the local concentrations of specific toxic VOCs in the air within 1 or 2 km of the source.

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## A Study of the Linear Ranges of Several Acid Digestion Procedures

David E. Kimbrough\* and Janice Wakakuwa

California Department of Health Services, Southern California Laboratory, 1449 West Temple Street, Los Angeles, California 90026-5698

■ The analysis of solids for the presence of regulated elements is most commonly performed using an acid digestion procedure. Implicit in published methods is the hypothesis that elements will be solubilized in direct proportion to their concentration in the matrix. The purpose of this study is to examine the validity of this hypothesis. Five variables are examined: (1) the total amount of the analyte, (2) the molecular form of the element, (3) the vigor of the acid cocktail, (4) the effect of other elements, and (5) the amount of hydrochloric acid used. Four acid digestion procedures were used over the range of 50–1 000 000  $\mu\text{g/g}$  for 16 elements in several molecular forms. In many cases, elements were not solubilized in a direct linear fashion so that a given acid digestion procedure was accurate and precise for a given element over a limited linear range. Four types of linear ranges were observed.

### Introduction

The determination of the concentration of regulated elements in solid matrices (sediments, sludges, soils, and solid wastes such as spent catalysts, press cakes, slags, powders, etc.) is generally performed using acid digestion procedures. The purpose of the acid digestion is to solubilize all the elements of interest. To do this, a digestion procedure must perform two distinct tasks: (1) It must decompose the sample matrix to expose the entire mass to the acid cocktail. (2) It must react with the elements of interest to form water-soluble compounds. When the digestion is complete, it is usual to add water to form a

solution that is suitable for analysis by a variety of analytical instruments (typically flame atomic absorption spectrophotometry (FAA) and inductively coupled plasma atomic emission spectroscopy (ICP-AES), but also graphite furnace atomic absorption spectrophotometry (GFAA) and inductively coupled plasma mass spectroscopy (ICP-MS)). If the digestion is successful, the amount of the element in the solution is equal to the amount of the element in the sample matrix. Ideally, a digestion procedure should be able to solubilize any amount of the elements of interest in the matrix, irrespective of the molecular state, so that a graph of the concentration of analyte in solution versus the concentration of analyte in matrix would be linear. Previous studies have shown that this is not always the case (1–3). There is a limit to the range of matrix concentrations that will yield a linear relationship, for a given digestion procedure. This is called the linear range. Above or below this range, the amount of analyte in solution is significantly lower than the amount in the sample matrix.

There are no data available on the linear ranges for most published acid digestion procedures. For example, EPA SW 846 method 3050 (4) lists silver as an applicable analyte. This is true if the amount of silver in the sample aliquot is less than 300  $\mu\text{g}$ . The method cannot solubilize more than this amount. None of the ASTM acid digestion (9.3) procedures indicate that the methods may be applicable only within a limited range for a given analyte. A recent review of digestion methods did not mention linearity (5). Therefore, analysts and review personnel have no guide for evaluating the data obtained from these methods. Linear ranges for target elements vary from



# Cerro Sues Monsanto For Cost Of Cleanup

By Daniel R. Browning  
Of the Post-Dispatch Staff

3/14/92

Cerro Copper Products Co. has filed suit seeking to force the Monsanto Co. and one of its subsidiaries to pay for the \$12.8 million cleanup of Dead Creek, a stream on Cerro's property in Sauget that was polluted with PCBs and other hazardous chemicals.

The suit, filed in U.S. District Court

in East St. Louis, contends that before August 1977 Monsanto's Krummrich Manufacturing Plant, at the northern end of the polluted stream, had been discharging waste water loaded with polychlorinated biphenyls, which are known to cause cancer.

Monsanto either knew or should have known that the toxic chemicals would intrude onto Cerro's property,

the suit says. As the generators of the hazardous substances and the owner-operator of the facility, Monsanto and Monsanto Chemical have engaged in "abnormally dangerous or ultrahazardous activities" and should be held strictly liable for all damages, the suit says.

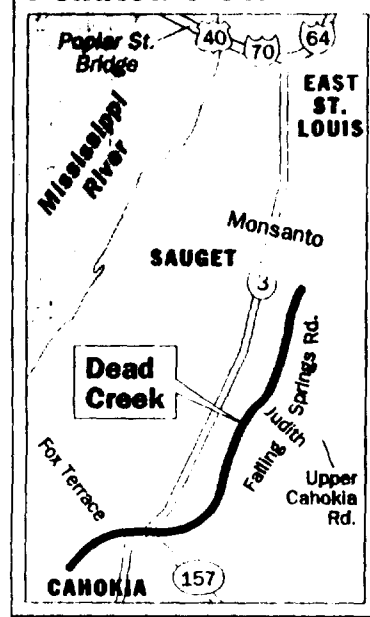
In 1990, the state of Illinois filed suit against Cerro under the Comprehen-

sive Environmental Response, Compensation and Liability Act to force it to clean up the property. Cerro entered a consent decree to clean up the property, resolving that suit.

Since then, Cerro has spent about \$12.8 million to clean up Dead Creek, the company says in its lawsuit. Cerro wants the court to declare Monsanto

See CERRO, Page 3

## Polluted Creek



Tom Borgman/Post Dispatch

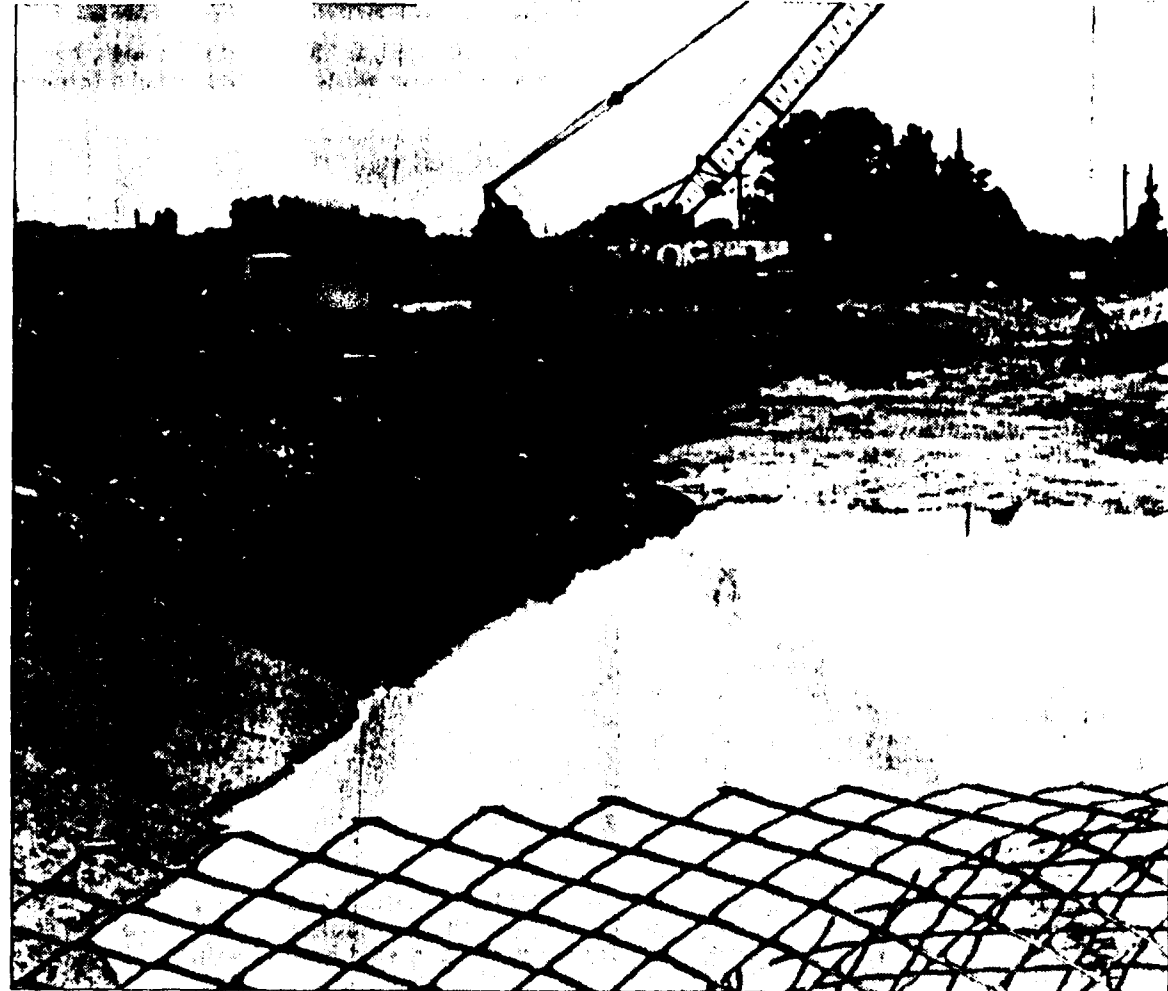
## Cerro

From page one

and Monsanto Chemical companies jointly and severally liable for the reimbursement costs, legal expenses and accrued interest.

The suit was filed Wednesday in U.S. District Court in East St. Louis, but it was not served immediately on Monsanto because the paper work had not been completed properly and had to be redone, a clerk said.

A spokesman for Monsanto Chemical, Kevin Cahill, said the company's attorneys were reviewing the suit on Friday.



Robert LaRouche/Post-Dispatch

**Dead Creek, once contaminated with PCBs and other chemicals, is the subject of a lawsuit filed this week. The suit seeks payment for the \$12.8 million cleanup costs.**

"We are disappointed that Cerro Copper Products Co. has chosen to take this action," Cahill said.

"Cerro decided on its own to do the remediation work in Sector A of Dead Creek, in agreement with the Illinois

Environmental Protection Agency and the Illinois Attorney General's Office," he said.

# Tossed salad Fire, coal mixture yields green savings at Monsanto

By Jeffrey Peyton  
Staff writer

Monsanto Chemical's Krummrich plant in September became one of the first U.S. manufacturers to use discarded automobile tires as a fuel for its boilers.

The Sauget plant's boilers now burn a "tossed salad" of shredded tires and coal.

Officials with Monsanto, the Illinois Environmental Protection Agency and the Illinois Department of Energy and Natural Resources all call the mixture a "win-win situation."

Bill Boyle, Krummrich plant manager, said the problem of disposing of discarded tires and rubber products appears to have been solved. At the same time, the new tire-derived fuel is further reducing the plant's toxic emission levels.

"Of course, it's an economic winner for us as well," Boyle added. Burning the new mixture is expected to save Monsanto more than \$500,000 annually.

IEPA Director Mary Gade had nothing but praise for the program.

"Tires do not decompose in landfills, and they can work their way back to the surface," she said. "Stored above ground, they are unsightly health and fire hazards."

"Using tires as fuel salvages energy which would otherwise be lost."

Dan Dennis, a Monsanto engineer who worked with IEPA and the Energy and Natural Resources Department, said the new fuel actually burns better than straight coal.

"Emissions from tests were actually lower than with straight coal in most areas," he said.

Monsanto spokesman Andi Smith said the company has burned more than a half-million tires since the project began. She added that the number of tires burned could grow to more than 2.5 million annually.

"This could solve the scrap tire disposal problem once and for all," Dennis said.

Tires do not decompose in landfills, and they can work their way back to the surface. Stored above ground, they are unsightly health and fire hazards. Using tires as fuel salvages energy which would otherwise be lost.

— Mary Gade  
IEPA director

2 27-45  
Oswego  
Ledger-Sentinel

## Workers clean-up Saw-Wee-Kee Park

59 barrels of  
dried paint  
removed

By John Etheredge

After the crane's steel tooth bucket pierced the side of the rusted barrel, the odor of paint in Saw-Wee-Kee Park Monday morning was unmistakable.

Using the crane, a small bulldozer, and a truck Monday and Tuesday, contractors for the Oswego Park District removed 59 barrels of dried paint from a section of the park off Sundown Lane in unincorporated Oswego Township.

The last of the barrels was taken from the park Tuesday morning. Site restoration work followed.

Tests of paint samples taken from one of the barrels by the Illinois Environmental Protection Agency (IEPA) last year determined that it contained lead in excess of federal standards and was classifiable as a hazardous waste.

Park district officials have said the barrels were at least 25 years-old and were dumped on the property when it was operated as a municipal garbage dump. The State of Illinois deeded the 150 acre park site to the park district in 1963.

A group of nearby homeowners have expressed concern that seepage and leakage of wastes from the park posed a health hazard and threatened contamination of nearby private water wells.

Park district commissioners voted last December to hire Heritage Remediation Engineering, Inc. of Romeoville to remove the barrels from the park and to dispose of the paint.

But since commissioners voted, work had been delayed in recent weeks pending the completion of laboratory tests by Heritage and then were further delayed due to unfavorable weather conditions.

Work, however, started Monday morning under the watchful eye of park district officials and an Illinois State Police officer assigned to environmental cases.

Gray, one of the observers, reported Tuesday morning that the last of the barrels had been removed from the park.

With the barrels removed, Gray said Heritage crews were set to cap the excavated area with a layer of clay.

Gray estimated the final cost for the project will be under \$30,000.

Earlier this month, Gray placed the final cost for the project at between \$24,000 and \$28,000 and said a final price was uncertain since the exact number of barrels at the site was then unknown.

Gray said park and Heritage officials had counted and removed a total of 59 barrels from the park.

Funds for the project, Gray said, will come from the park district's capital development budget, a fund the district normally draws upon to develop or improve local parks.

Heritage crews were expected to place the barrels and their contents in a IEPA approved landfill in Indiana.

Hillside  
West Proviso Herald  
3,275 W. 26th

## Energy plan is no garbage

Instead of being known as the town with a garbage dump, Hillside officials hope to become the town that produces energy.

Village trustees last week amended existing zoning laws to allow the John G. Sexton Sand & Gravel Corporation and Browning-Ferris of Illinois, managers of the Hillside landfill, to remove methane gas from the garbage mounds and convert it into either electricity or a gas fuel on the site.

"I do think it's a step in the right direction. We all learned a long time ago we are

not getting rid of the landfill, it was not going away," said Village President Joseph Tamburino. "There's no doubt in my mind that the people who run the landfill intend to make that a showplace."

Tamburino said the village might be able to collect revenues from the landfill once it becomes an energy producer. There is also the possibility that the Illinois Environmental Protection Agency will require landfills to produce alternative sources of energy in years to come, he said.

# Cerro Copper Co., EPA Agree On Cleanup, Fine

By Patrick E. Gauen  
Of the Post-Dispatch Staff

11/20/90

A proposed settlement with federal regulators calls for Cerro Copper Products Co. in Sauget to spend \$3.2 million to clean up its toxic sewage and to pay a \$1.4 million penalty for past violations.

The agreement would be another step in trying to clean up the fetid environment of the small industrial community at the southern edge of East St. Louis, U.S. Environmental Protection Agency officials said Monday.

The "consent decree" between Cerro, the EPA and Justice Department was announced Friday and will be open for public comments for about 30

days before being taken to a federal judge in East St. Louis for a court order to finalize its terms.

This negotiated settlement of Clean Water Act violations alleged in a complaint in 1989 heads off a possible fine of \$500 million if Cerro had lost its case in a trial.

Dat Njo, a chemical engineer for the EPA in Chicago, said the agency was negotiating privately with other industries in the Sauget area that also had failed to pretreat harmful chemicals in the sewage they pipe to the American Bottoms Regional Treatment Facility at Sauget.

Officials said the American Bottoms plant's discharge into the Mississippi River is the most toxic waste-water

See CERRO, Page 6

## Cerro

From page one

effluent in the six-state region overseen by the EPA's Chicago office.

Cerro President Henry L. Schweich said in a prepared statement that the EPA had not contended in this suit "that the discharges adversely affect either the environment or the water quality of the Mississippi River."

Njo said in a telephone interview that Schweich's statement was true but "self-serving" since the EPA was continuing to investigate the sources of the dangerous chemicals entering the river through the treatment plant.

Cerro employs 850 people in what the company says is the world's largest copper recycling and tube-making operation. It is a subsidiary of Marmon Group Inc. of Chicago.

Part of its newly agreed waste processing will permit the recycling of copper sulfates from the sewage.

Dales S. Bryson, regional water division director of the EPA in Chicago, said, "The environmental advantages of recycling are obvious, but the company will realize an economic benefit as well. Creative solutions to environmental problems can be good

**Officials said the American Bottoms plant's discharge into the Mississippi River was the most toxic in the EPA's six-state Chicago region.**

business."

Cerro initially denied wrongdoing after the sewage complaint. But in a company news release, Schweich said, "As a pragmatic matter, by settling this litigation now, we will avoid continued disruption to our business, as well as a long and expensive legal battle that would cost both us and the taxpayers unnecessary time and money."

In July, Cerro agreed in another consent decree to spend \$14 million to remove contaminants from a portion of Dead Creek, a stream that over the years has become a cesspool of dangerous chemical wastes from nearby industries.

Dan Dipiazza, a spokesman for Cerro, said that final landscaping work at Dead Creek would be finished by the end of this month.

# Suit Called Part Of Larger Sauget Cleanup Effort

By Robert L. Koenig 3/23/89  
Post-Dispatch Washington Bureau

WASHINGTON — The federal suit filed last week against a copper recycling company in Sauget, Ill., is related to a wider effort to clean up toxic wastes emerging from Sauget's treatment plants into the Mississippi River, federal officials say.

In the civil suit, the U.S. Department of Justice charged the Cerro Copper Products Co. with some 50,000 violations since 1984 of federal clean-water laws. The maximum fine for those violations would be more than \$500 million, officials said.

Henry Schweich, the president of Cerro Copper, said in a telephone interview this week that "the litigation is totally without merit, and we will defend ourselves."

But Donald Carr, the acting assistant U.S. attorney general in the Justice Department's natural resources division, charged that Cerro Copper

"flagrantly violated the Environmental Protection Agency's regulations requiring pre-treatment of pollutants" before they are discharged into public waste-treatment plants.

Charles H. Suffin, who heads the water division of the federal EPA's regional office in Chicago, said that "because Cerro failed to install pre-treatment facilities, more than 300,000 pounds of toxic pollutants have been discharged annually" into public waste-treatment plants in Sauget and into the Mississippi River.

At issue is whether Cerro Copper properly pre-treats pollutants from its plant — including such heavy metals as copper, chromium, lead, nickel, zinc and some "toxic organics" — before they are discharged into the Physical Chemical treatment plant in Sauget. From there, the chemicals pass through treatment processes at the American Bottoms plant before they are discharged into the Mississippi River.

**"It's the most toxic waste water ever measured in our region."**

ANNE WEINERT, environmental engineer with EPA Chicago office

EPA officials contend that the discharge from the American Bottoms plant is the most toxic in a six-state area that includes Illinois, Wisconsin, Minnesota, Indiana, Ohio and Michigan.

"It's the most toxic waste water ever measured in our region," said Anne Weinert, an environmental engineer with the federal EPA's regional office in Chicago.

But officials in Sauget deny that the sewage discharge into the Mississippi is toxic or has damaged the river's ecology.

In one major step of the campaign to clean up the waste treatment system, the federal EPA sued Sauget last spring for violating federal clean-water laws by discharging heavy metals as well as millions of gallons of ammonia, phenols and other toxic chemicals.

On March 15, Sauget officials agreed to begin a process using powdered carbon at the American Bottoms plant to remove some of those toxic chemicals. That agreement was part of a consent order entered in the court of U.S. District Judge William

Beatty in Alton.

But Weinert said the powdered-carbon treatment is not really an effective treatment process for the heavy metals that come out of the Cerro Copper plant. They are discharging pollutants that have the potential to pass through both those sewage treatment plants.

Richard Kissel of Chicago, an attorney who represents Cerro Copper and also represents the Village of Sauget on some issues, said in a telephone interview that the company had been working with Sauget and with environmental officials since the 1970s to make sure its complies with federal and state clean-water laws.

"There's been a long history of industry in Sauget working with the EPA to improve waste treatment in Sauget," said Kissel, who asserts that the discharge by the American Bottoms plant into the Mississippi "meets the standards" set in the permit for that plant.

Calling Cerro Copper "the major copper recycler in the United States," Kissel said: "This type of recycling industry ought to be encouraged, not discouraged" by the government.

Schweich, the president of Cerro Copper, said the company employed 850 workers at its plant in Sauget and 150 at a plant in Shelbyville, Mo., near Hannibal. He said the company recycled about 200 million pounds of copper a year and used it to manufacture copper tubing and electrical goods.

The suit filed last week against Cerro Copper in U.S. District Court in East St. Louis seeks court orders barring waste-water discharges that violate EPA regulations. The suit also seeks civil penalties of \$10,000 for each day of violations before Feb. 5, 1987, and \$25,000 a day for violations after that date.

Tim Novak of the Post-Dispatch staff contributed information for this story.



217/782-6760

Refer to: L1630200005 -- St. Clair County  
Sauget Sites (Dead Creek Segment B) -- Sauget  
Superfund/Technical Reports

October 11, 1991

Mr. Steven D. Smith  
Manager of Remedial Projects  
Monsanto Chemical Company  
800 North Lindbergh Boulevard  
St. Louis, Missouri 63167

Dear Steve:

The Illinois Environmental Protection Agency (IEPA) is in receipt of the "Work Plan for a Site Investigation for Dead Creek Sector B, and Sites L and M, Sauget - Cahokia, Illinois". Since the report was only submitted to IEPA three days ago, a full review was not possible. Nevertheless, I have been able to provide comments on this document before work was scheduled to begin.

Because general provisions and guidelines are normally memorialized in a Consent Decree before work is to proceed, IEPA is not in the position to approve or disapprove this work plan. In addition, IEPA cannot guarantee that existing data, in conjunction with the work that Monsanto is about to undertake will adequately characterize the waste areas for the purposes of a remedial action or a remedial investigation.

My general comments on the work plan are as follows:

1. Based on existing data, it is apparent that the most highly contaminated areas of Dead Creek Segment B (CS-B) are located near Queeny Avenue. Since Monsanto has not been able to obtain access in these areas, it may be necessary to construct a berm so that contamination coming off of Site G does not interfere with sampling activities. This will be necessary if Monsanto elects to remediate these areas.

2. Aerial photographs have indicated that Waggoner & Company had also operated another waste impoundment to the east of Site L. Since the function of this work plan is to characterize creek sediments, off-site sources such as this one (and also Sites G, H, and L) impacting CS-B cannot be overlooked.

3. It is highly advisable to use USEPA's most current QAPP model. In the event that remediation would not be possible, this data would be usable in an Area 1 Superfund RI.



4. If remediation is being considered, a decision will eventually need to be made regarding the plugged culvert at Judith Lane. The Village of Cahokia intends to make Dead Creek free flowing again, and if the northern portions of CS-B are not remediated, removal of the plug would enable the migration of contaminants into Cahokia.
5. The work plan should indicate that contaminant fate from compounds in CS-B would be discussed in the Site Investigation report. The plan should also include a discussion on the effects of low permeability areas in CS-B and the regional effects of decreased industrial pumpage in the area.
6. Historical estimations on VOC concentrations in CS-B may not have been entirely correct. When CS-B samples were evaluated by Ecology and Environment (E&E) in 1986, it was noted that improper medium concentration methodologies used by the laboratory could have caused faulty VOC measurements (page 4-94; E&E Report). These errors should be noted by all personnel performing field work.
7. A discussion on the waste disposal practices of Midwest Rubber Reclaiming Company (MRRC) should be included. IEPA has documentation that an 18 inch outfall pipe originating at the plant had been used to dispose of process waster in CS-B. The discharge point is located about 200 feet south of Queeny Avenue. Pine tars, naphthalene and other toxic organics resulting from MRRC's manufacturing process have caused contamination in CS-B. Because of the nature of this discharge, portions of CS-B have been "rubberized". In addition to the physical contamination, the subsequent "rubberization" of the creek has raised the possibility that pockets of unreacted chemicals (i.e. phosphorus) may exist. Personnel performing field activities should be made aware of this.

Specific comments are as follows:

1. Section 1.2.1, first paragraph - In the sixth sentence, please note that water fluctuations in CS-B are due to precipitation events only since CS-B is above the saturated zone. Groundwater elevations, on the other hand, do effect water levels at Site M. This paragraph should also mention rubberization effects.
2. Page 3 - Monsanto's title records indicate that Site L is still owned by Ruan Trucking Company and not Metro Construction. The impoundment mentioned in General Comment #2 is partly owned by L. Keeley Paving & Construction.
3. Section 1.2.2, first paragraph - The history of the site should indicate that prior to the construction of the Village of Monsanto interceptor sewer system, CS-B received wastewater discharges from local industries. Also mention MRRC's discharges.
4. Page 4, first paragraph - As far as Site L history is concerned, it is more likely that Ruan Trucking leased the property and its equipment from Harold Waggoner when the title of the property was



transferred from Harold Waggoner & Company to Harold Waggoner in 1975. Also, Ruan did not purchase Site L until 1981.

5. Section 1.2.3, first paragraph - It should be noted that in the St. John report, PCBs were found at levels of up to 10,000ppm.

6. Section 1.2.3, second paragraph - The function of the E&E investigation was to provide data for an HRS package, it was not an RI. Also note that 8 sediment samples were collected in CS-B. Three of these were dioxin samples which were negative.

7. Page 5, second paragraph - E&E noted very high PCP levels at Site L.

8. Page 5, last paragraph - The final amount of contaminated material removed from Dead Creek Segment A (CS-A) was 24,000 cubic yards.

9. Section 2.2 - This section should note that Sites G, H, and L drain into CS-B. The relationship between CS-B and Site M should also be further explained.

10. Section 3 - The CS-A study by the Avenet Group proposed four borings per profile across the creek. This included two borings in the creek to define the sediments and two additional borings to define creek boundaries. A similar approach should be employed here.

The proposed drilling depth (7 feet) will not adequately characterize creek segments. The St. John report indicated that creek sediments are present to 10 feet and that in G103, a "black petroleum substance" was present at 30 feet. This indicates that creek staining may be present at great depths as it is unlikely that the staining could have migrated from Sites G, H, L or I.

In this paragraph, the visual standards should also be clearly identified. The field geologist should also note the physical characteristics of the creek sediment.

11. Page 9, third paragraph - Monsanto should take additional TCLP samples in the creek, especially in the area where Waggoner disposed of wastes.

12. The last paragraph on page 9 should note where any standing water would be pumped to.

13. Section 3.2 - The E&E report indicated that the Site L impoundment was approximately 8 feet deep and that staining was observed in all borings to 25 feet. Borings taken at Site L should, at minimum, be 25 feet. More TCLP testing should be done here also.

14. Section 3.3 - More sampling needs to be done at Site M. Since it is possible that drums might have been disposed of here, it may



be necessary to drain Site M in order to fully characterize it.

15. Table 1 (VOC-CS-B) should note that sample depths in all CS-B borings were 0 to 6 inches. Also, all concentrations for methylene chloride, acetone, and 2-hexanone were detected in blanks. The values for benzene and 4-methyl-2-pentanone are 87Jppb and 220Jppb, respectively.

16. Table 1 (VOC-Site L) should include a concentration of toluene at DC-L4-10 of 50ppb.

17. Table 1 (VOC-Site M) should note that sample depths at Site M were 0 to 6 inches.

18. Table 2 (SVOC-CS-B), should note proper sample depths. Also, the value for phenol should be 1800ppb.

19. In Table 3 (Pest/PCB-CS-B & Site M), note proper sample depths. Also note that PCBs were not tested for at Site M.

20. In Table 4, please note that cyanide was not detected anywhere. Also, change sample depths at Site M.

Appendicies A, B, and C were not reviewed by this author

If you have any questions or concerns about these comments, please do not hesitate to call me.

Sincerely,

Paul E. Takacs, Project Manager  
Federal Sites Management Unit  
Remedial Projects Management Section  
Division of Land Pollution Control

cc: Terry Ayers  
Charles Zeal  
Jim Morgan, IAGO  
Division File





(217)782-6760

Refer to: L1630200005 -- St. Clair County  
Sauget Sites (Areas I and II)  
Superfund/Compliance

April 18, 1990

Morris Weissman  
345 Hudson Street  
New York, New York 10014

Dear Mr. Weissman:

The Illinois Environmental Protection Agency ("IEPA") and the Illinois Attorney General's Office are in receipt of your letter dated March 21, 1990 and Richard Cohen's letter dated March 27, 1990. In reference to the information request letters which were sent to you and the other former stockholders of GIT Industries, Inc. ("GIT") on March 12, 1990, IEPA is inquiring about the past operations of a rubber reclaiming facility (the "Facility") in Sauget, Illinois that belonged to Midwest Rubber Reclaiming Company ("MRRRC").

MRRRC was formerly a Delaware corporation of which our records indicate you and Mr. Cohen were directors and officers. MRRRC was a wholly owned subsidiary of GIT, also a former Delaware corporation. MBS Chem, Inc. (now known as Empire Chem, Inc.) acquired the Facility on or about September 29, 1986. As part of the acquisition, MRRRC transferred all of its interest in a promissory note of MBS Chem, Inc. to GIT on or before November 6, 1986. GIT transferred its interest in that note to three of its stockholders, including you and Mr. Cohen, effective November 6, 1986.

Regarding your status as a potentially responsible party ("PRP") for Area I, enclosed is a copy of a blueprint entitled "Village of Sauget Sewer System Layout". The drawing shows an 18 inch outfall originating at the former MRRRC property. The discharge point is located approximately 200 feet south of Queeny Road into Dead Creek. Pine tars, naphthalenes and other toxic organics, which result from impurities in rubber synthesis have been found in this segment of Dead Creek, downstream of the outfall. Because of the nature of this type of discharge, a significant portion of this creek has been "rubberized". In addition to the physical contamination, the subsequent "rubberization" of the creek has caused contaminated stormwater runoff to collect in this area, thereby creating additional health hazards. These discharges are widely believed to have originated from operations at the Facility prior to the above-described transactions.

Your PRP status in Area II pertains to similar industrial discharges made to the Village of Sauget Treatment Plant from the mid 1960s until August 31, 1980. Lagoons at this treatment plant, which have been closed since 1980, have shown extensive contamination and have since become the focus of an areawide investigation. Due to the nature of contamination found at these lagoons and in the segment of Dead Creek mentioned earlier, inclusion on the National Priority List has been proposed.

All addresses and technical information has been provided by the "Expanded Site Investigation - Dead Creek Project Sites, Sauget, Illinois" (IEPA, 1988), "A Preliminary Hydrogeologic Investigation in the Northern Portion of Dead Creek and Vicinity" (IEPA, 1981), and the PRP group of Area I.

If you have any further questions regarding this matter, please do not hesitate to contact Paul Takacs of my staff at the above number.

Sincerely,

Handwritten signature of William C. Child in black ink.

William C. Child, Manager  
Division of Land Pollution Control

WCC:mm/03-5  
Enclosure

cc: Terry Ayers  
Paul Takacs  
Bruce Carlson  
James Morgan  
Richard Cohen  
Stanley Kreitman  
Paul Shorb  
Division File

10

**DEAD**

AVENUE

### 4. OVERFLOW

205

LINE

204

201

212

CO.

204